

REMARKS

Claims 1-37 were examined and rejected. Claims 38-48 have been previously been canceled. Applicants do not amend, cancel or add any claims. Applicants respectfully request reconsideration of claims 1-37 in view of at least the following remarks.

I. Claim Rejections Under 35 U.S.C § 112

The Patent Office rejects claims 1 through 37 under 35 U.S.C. § 112, first paragraph as failing to comply with the written description requirement with respect to the prior amendments addition of "one or more of the first and second semiconductor materials forming a film comprising attached halide particles extending along the heterojunction," to claims 1 and 17; and "wherein at least one of the first and second semiconductor materials comprises a substantially solid phase film," to claims 30 and 31.

Applicants respectfully disagree and submit that the prior amendment to claims 1 and 17 is supported at paragraphs 1 -9, 26 and 34-35; and figures 1 through 3 of the Application as originally filed. The above noted portions of Applicants' specification provide examples only, without limiting the claims thereto.

For example, different sections of paragraphs 1 - 9 describe in the cited examples, but do not combine in the manner claimed, (1) x-ray detector semiconductor materials including lead iodide or mercuric iodide; (2) layers of intrinsic semiconductor material, such as 120 and 183 of fig. 1B and 1C (known in the industry as a pure semiconducting material having attached semiconductor particles); and (3) heterojunctions of dissimilar semiconductor materials (e.g., p-n) (see paragraph 8 of the application as-filed). Later, at paragraphs 25-28, the specification describes photodetectors having heterojunction structure with layers of mercuric iodide and lead iodide. Then, at paragraphs 29-30 and Figures 2A and 2B, the specification describes and shows halide semiconductor layers 230 and 240 of fig. 2A and 2B having particles thereof extending along the heterojunction therebetween. Next, at paragraph 35 and Figure 3 (e.g., block 340), the specification describes and shows semiconductor materials (e.g., semiconductor layers 230 and 240) can be formed by various techniques, such as chemical vapor deposition (CVD), sputter, ion beam deposition, etc.

Thus, upon reading the specification, a practitioner in the art would find the application, as filed, to include intrinsic layers of semiconductor materials, including a film comprising attached semiconductor (e.g., halide) particles extending along a heterojunction, as required by claims 1 and 17. Hence, Applicants respectfully request that the Office withdraw the rejection above with respect to claims 1-29.

With respect to claims 30 and 31, an argument analogous to the one above applies as well. Specifically, upon reading the above identified paragraphs and considering the above identified figures of the Applicants' specification as originally filed, a practitioner in the art would find semiconductor material comprising a substantially solid phase film to be supported by the specification as originally filed. Specifically, examples of solid phase film, without limiting the claims thereto, can be found with respect to intrinsic layers 120 and 183 of fig. 1B and 1C; layers 230 and 240 of Figure 2A and 2B; and films formed by various techniques described at paragraph 35, such as chemical vapor deposition (CVD), sputter, ion beam deposition, etc. Hence, Applicants' respectfully request that the Patent Office withdraw the rejection above with respect to claims 30 -37.

II. Claims Rejected Under 35 U.S.C. §§ 102 and 103

The Patent Office rejects claims 1-9, 14, 16-18, and 20-37 under 35 U.S.C. §§ 102(b) and 103(a) as being anticipated by and obvious over WO 02/067014 to Harel et al. (Harel). It is axiomatic that to be anticipated, every limitation of a claim must be disclosed within a single reference. Also, to render a claim obvious, all limitations of that claim must be taught or suggested by at least two properly combined references.

Applicants respectfully disagree with the rejection above of claim 1, as amended, for at least the reason that the cited references do not teach or suggest a photodetector comprising a heterojunction formed of two semiconductor materials, being halides, and one or more of the first and second semiconductor materials forming a film comprising attached halide particles extending along the heterojunction, as required by amended claim 1. According to claim 1, for example and without providing limitation thereto, one of the two materials that form the heterojunction may be a film having halide particles attached to each other within the film extending parallel to and along a heterojunction of two dissimilar semiconductor materials (see paragraph 8 of the application as-filed). Such a film may be formed by various techniques including

chemical vapor deposition (CVD), sputter, and ion beam deposition (e.g., as noted in paragraph 35 of the Applicants' specification as filed). The film having attached halide particles claimed in claim 1 excludes only films of particle-in-binder (PIB) material.

Harel teaches producing wide band gap semiconductor particle-in-binder (PIB) composite detectors having particulate semiconductors combined with polymeric binders. (See page 4, lines 1-3) Specifically, Harel describes grains of mercuric iodide powder mixed with a binder, such as acrylic, ester derivatives, rubber, polymers, etc. (See page 19-20, lines 6-7) The material is mixed thoroughly to wet all of the particles of mercuric iodide powder and to obtain a homogenous mixture (see page 20, lines 6-7) which is then applied to an adhesive coated substrate by screen printing (S.P.) die pressing, doctor blade, slot coater, or Mayer rod (see page 20, lines 8-16; page 14, lines 9-11; and page 15, lines 15-18). Moreover, Harel teaches a photoconducting hybrid bi-layer detector plate 10 having a primary layer of mercuric iodide (5) over a buffer layer of lead iodide (4) (see page 30).

However, the Patent Office has not identified and Applicants are unable to find any description in Harel that teaches or suggests that the junction between the primary layer 5 and buffer layer 4 is a heterojunction (e.g., that the primary layer 5 and buffer layer 4 are two dissimilar semiconductor materials), as required by amended claim 1.

Next, the Patent Office has not identified and Applicants are unable to find any description in Harel that teaches or suggests attached halide particles extending along the heterojunction, as required by amended claim 1. For instance, it can be appreciated that the particles of mercuric iodide powder, wet with the binder in a homogenous mixture, will not form mercuric iodide particles attached to each other all along the junction between layers 4 and 5, and thus do not describe halide particles attached to each other extending along the junction. Also, although the PIB composite may include, on occasion, attached halide particles at various locations, it is not necessary that the material include attached halide particles extending along the junction. For instance, Harel teaches a binder, such as a Polymeric Binder as part of the imaging composition existing in a radiation detector plate (see Harel page 4). Thus, binder will exist between some of the semiconductor particles within the plate. Hence, it is not disclosed or necessary that attached halide particles exist extending along the junction because the binder will exist at locations along the junction between the particles of Harel.

Moreover, Harel teaches binders that do not appear to include conductive or semiconductive material (see, Harel, pg. 19, last para. through pg. 18, first para.). For instance, in one example Harel teaches polystyrene in toluene mixed thoroughly with mercuric iodide powder to obtain a homogeneous mixture (see, Harel, pg. 20, lines 6-7). As a result, Harel teaches non-conductive binder existing between the particles along the junction of Harel. Hence, for at least the reasons above, the reference does not teach or suggest the limitations above, and Applicants respectfully request the Patent Office withdraw the rejection of claim 1 above.

Also, the background of Harel indicates that single crystal or polycrystalline semiconductor structures have disadvantages which the PIB composite improves. Thus, Applicants believe that upon reading the background and other sections of the specification of Harel, a practitioner in the art would not be motivated to create the semiconductor material claimed in Applicants' independent claims, since the single crystal or polycrystalline semiconductor structures are what the PIB composite of Harel is designed to replace. Hence, for at least the reason above, the reference does not teach or suggest the limitations above, and Applicants respectfully request the Patent Office withdraw the rejection of claim 1 above.

Furthermore, the purpose of the PIB composites of Harel is to use the PIB composites in place of single crystal materials or polycrystalline materials (e.g., solid phase semiconductor films) to improve the shortcomings of single crystal materials or polycrystalline materials (see background of Harel). Specifically, Harel teaches a radiation detector plate including a composition layer comprising an addmixture of particulate semiconductor with a polymeric binder (see, Harel pg. 4, para. 2), to allow for better direct X-ray radiation to electrical signal conversion that in prior art converters, while having a sensitivity close to the order of magnitude obtained by polycrystalline detector plates and imagers produced by PVD-type processes (see, Harel pg. 3, 1st para. of Summary of Invention Section). Harel also points out that the primary PIB layer has a sensitivity only 40-50% of that of non-composite polycrystalline HgI₂-PVD produced imagers (see page 18 paragraph 3 and Figure 6).

Thus, Harel distinguishes its PIB composite from those structures, and identifies its PIB composite as an improvement to those structures, although less sensitive. As a result, Applicants believe that the claimed structure, which requires attached halide particles (or a semiconductor material film comprising a substantially solid phased film

as required by amended claims 30 and 34), is taught away from by Harel. As such, Applicants believe that the independent claims, which include the semiconductor materials in combination with other limitations, are patentable over Harel. Hence, for at least the reason that the reference teaches against the limitations above, Applicants respectfully request the Patent Office withdraw the rejection of claim 1 above.

Applicants submit that dependent claims 2-9, 14, 16-18, and 20-29, being dependent upon allowable base 1, as amended, are patentable over the cited references for at least the reasons explained above. Thus, Applicants respectfully request that the Patent Office withdraw the rejection of dependent claims 2-9, 14, 16-18, and 20-29 as being unpatentable over the cited references.

Next, Applicants respectfully disagree with the rejection above and submit that independent claims 30 and 31, as amended, are patentable over the cited references for at least the reason that the cited references does not teach or suggest a first semiconductor material and a second semiconductor material, at least one of which comprises a substantially solid phase film, as required by those claims. Accordingly, to claims 30 and 31, for example and without providing limitation to those claims, the first film of semiconductor material may be a film of one type of semiconductor material particles attached to each other substantially in a solid phase, such as a film of intrinsic semiconductor material (known in the industry as a pure semiconducting material having attached semiconductor particles). Such a film may be formed by various techniques including chemical vapor deposition (CVD), sputter, and ion beam deposition (e.g., as noted in paragraph 35 of the Applicants' specification as filed). The film having attached halide particles claimed in claims 30 and 31 excludes only films of particle-in-binder (PIB) material.

As noted above with respect to the argument for claim 1, Harel describes a particle-in-binder (PIB) material including mercuric iodide powder thoroughly wet with a binder to obtain a homogenous mixture of powder particles and binder. Also, Harel teaches PIB composites including a binder, such as a non-conductive polymeric binder within a composition layer of a radiation detector plate (see, Harel pp. 3-4). Thus, the composition layer of particulate semiconductor with a polymeric binder, or the PIB composition layer of Harel does not teach or suggest a semiconductor material comprising a substantially solid phased film.

Consequently, the Patent Office has not identified and Applicants are unable to find any description in Harel that teaches or suggests a film of semiconductor material substantially in a solid phase, as required by independent claims 30, and 31. Hence, for at least this reason, Applicants respectfully request that the Patent Office withdraw the rejection of independent claims 30 and 31, as amended.

Applicants submit that dependent claims 32-37, being dependent upon allowable base claims 30 and 31, as amended, are patentable over the cited references for at least the reasons explained above. Thus, Applicants respectfully request that the Patent Office withdraw the rejection of dependent claims 32-37 above.

In addition, Applicants respectfully traverse the Patent Office's assertion that the claimed differences in conductivity type and band gap of claims 16-17 is an inherent teaching of Harel, because of the material properties, and respectfully requests the Patent Office cite a reference in support of those positions in accordance with MPEP § 2144.03. For instance, the PIB materials of layers 4 and 5 of Harel may have conductivities or have band gaps other than those claimed in claims 16-17. Hence, for at least this second reason, Applicants respectfully request that Patent Office withdraw the rejection above of dependent claims 16-17.

III. Claims Rejected Under 35 U.S.C. § 103

The Patent Office rejects claims 10-13, 15, and 19 under 35 U.S.C. § 103(a) as being unpatentable over Harel. To render a claim obvious, all elements of that claim must be taught or suggested by at least two properly combined references.

Applicants respectfully disagree with the rejection above and submit that dependent claims 10-13, 15, and 19, being dependent upon allowable base claim 1, as amended, are patentable over the cited references for at least the reasons explained above. Thus, Applicants respectfully request that the Patent Office withdraw the rejection to dependent claims 10-13, 15, and 19 above.

In addition, Applicants respectfully traverse the Patent Office's assertion that although Harel does not disclose the specific limitations of claims 10-13, 15, and 19, that those ranges would be obvious to a practitioner in the art from the thicknesses for lead iodide provided on page 31 and for an embodiment including mercury iodide, but not lead iodide on page 29 and requests that the Patent Office cite a reference in support of that position in accordance with MPEP § 2144.03.

Specifically, at pg. 29, Harel teaches example 14 having a detector plate with a final thickness of 150 microns, but does not teach a specific thickness of either a first or second semiconductor material layer. Then, on pg. 31 Harel teaches a 200 micron thick layer of lead iodide PIB paste in a detector plate having an overall thickness of 400 microns (see, Harel pg. 32). Thus, the 200 microns thick of lead iodide of pg. 31 cannot be combined with the 150 microns final thickness detector plate of pg. 29, because the lead iodide layer is thicker than the entire detector plate of pg. 29. Finally, fig. 15, referred to on pg. 31 of Harel teaches equally thick detector layers each having a thickness of 300 microns. Thus, at pg. 31 Harel does not teach layers having different thicknesses, but instead a way with fig. 15. Moreover, none of the teachings of Harel include a thickness less than approximately 50 microns (see, Applicants' claims 10, 13 and 15). Nor does Harel teach a first semiconductor material of lead iodide and a second semiconductor material thicker than the lead iodide (see, Applicants' claim 11), because Harel does not teach or suggest a layer thicker than the 200 micron thick lead iodide layer of example 15 or the 300 micron thick lead iodide layer of fig. 15.

For at least these additional reasons, Applicants respectfully request that the Patent Office withdraw the rejection above of the dependent claims 10-13, 15, and 19.

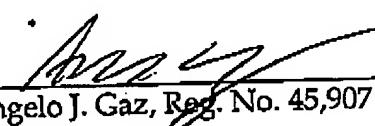
CONCLUSION

In view of the foregoing, it is believed that all claims now pending patentably define the subject invention over the prior art of record and are in condition for allowance, and such action is earnestly solicited at the earliest possible date.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2666 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17. If a telephone interview would expedite the prosecution of this Application, the Examiner is invited to contact the undersigned at (310) 207-3800.

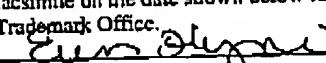
Respectfully submitted,
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CERTIFICATE OF FACSIMILE:

I hereby certify that this correspondence is being transmitted via facsimile on the date shown below to the United States Patent and Trademark Office.


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